

EXTRACT

CLIMATE CHANGE IN THE MEDIA

REPORTING RISK AND UNCERTAINTY

JAMES PAINTER



REUTERS
INSTITUTE for the
STUDY of
JOURNALISM

I.B. TAURIS

LONDON · NEW YORK

Published by I.B.Tauris & Co. Ltd in association with
the Reuters Institute for the Study of Journalism, University of Oxford

About the Book

Scientists and politicians are increasingly using the language of risk to describe the climate change challenge. Some researchers have argued that stressing the ‘risks’ posed by climate change rather than the ‘uncertainties’ can create a more helpful context for policy makers and a stronger response from the public. However, understanding the concepts of risk and uncertainty – and how to communicate them – is a hotly debated issue. In this book, James Painter analyses how the international media present these and other narratives surrounding climate change. He focuses on the coverage of reports by the Intergovernmental Panel on Climate Change (IPCC) and of the melting ice of the Arctic Sea, and includes six countries: Australia, France, India, Norway, the UK and the USA.

‘How the media communicates risk and uncertainty about climate change is critically important. This book highlights good and bad practice by the media and provides extremely sensible suggestions for improvements in the future.’

Lord (Nicholas) Stern, Chair, Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science

About the Author

James Painter is Head of the Journalism Fellowship Programme at the Reuters Institute for the Study of Journalism, Oxford University. He worked for several years for the BBC World Service and has written extensively on climate change and the media. His latest publication is *Poles Apart: The International Reporting of Climate Scepticism* (Reuters Institute for the Study of Journalism, Oxford University).

What follows is a short extract from this book.

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‘How the media communicates risk and uncertainty to their audiences is a critical issue. It is vitally important that the public are aware of the risks associated with unmanaged climate change. As this book points out, the media need to convey this information clearly and accurately without resorting to scaremongering. It highlights both good and bad practice by the media and provides extremely sensible suggestions for improvements in the future.’

Lord (Nicholas) Stern, Chair of the Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science

‘Our climate system is very complex, and predictions about its future are inevitably uncertain. However, uncertainty does not imply inaction. Rather, good decision making in climate-sensitive sectors will require not only predictions of the most likely climate change, but also reliable estimates of the uncertainty in future climate change. This report makes a valuable contribution in describing uncertainty prediction in climate science and highlights areas where this area of science could be promoted better, in the media and elsewhere.’

Tim Palmer, Royal Society Research Professor in Climate Physics, Oxford University

‘Communicating the observed and potential consequences of climate change is a challenging task, one that is often done poorly in the media. This important book provides many valuable insights into the use of a risk framework to communicate climate change. It is essential reading for those in the climate change communication business, especially those in the media who want to take an informed and professional approach to the topic.’

Will Steffen, Climate Commissioner, Australia

‘This is a really valuable book about the framing of the climate debate as an issue of ‘risk’, emphasising that, in spite of inevitable uncertainty about the future, we can still take appropriate action to hedge against bad outcomes. It is heartening to see the dual role of number and metaphor in communication – my favourite analogy is with setting up a good pension as a sensible precaution for the highly likely, but of course not certain, prospect of an extended old age.’

David Spiegelhalter, Winton Professor for the Public Understanding of Risk, Cambridge University

‘This is essential reading for any scientist, including IPCC authors, who are in the business of communicating risk and uncertainty about climate change to policy makers, the public or the media.’

Cecilie Mauritzen, Director, Center for International Climate and Environmental Research (CICERO), Oslo Norway

‘The latest in a series of incredibly useful and important studies shedding light on one of the most important, yet complicated and misunderstood, stories in journalism.’

Curtis Brainard, Contributing Editor, *Columbia Journalism Review*

‘It’s as hard to find the right language to convey climate change as it is to explain love or describe jazz. This abundantly referenced study is an essential guide for journalists through the new language of risk.’

Richard Black, former BBC environment correspondent

RISJ CHALLENGES

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Published in 2013 by I.B.Tauris & Co. Ltd
6 Salem Road, London W2 4BU
175 Fifth Avenue, New York NY 10010
www.ibtauris.com

Distributed in the United States and Canada Exclusively by Palgrave Macmillan
175 Fifth Avenue, New York NY 10010

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ISBN: 978 1 78076 588 4

A full CIP record for this book is available from the British Library
A full CIP record is available from the Library of Congress

Library of Congress Catalog Card Number: available

Typeset by 4word Ltd, Bristol
Printed and bound in Great Britain by CPI Group (UK) Ltd, Croydon, CR0 4YY

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Executive Summary

Politicians, scientists, and policy makers are increasingly using the concept and language of risk in a context of uncertainty to frame what is probably the greatest challenge this century, human-induced climate change. As much of the debate about climate change concerns the future, it inevitably involves degrees of uncertainty about the timing, pace, and severity of possible impacts, as well as the options for managing and avoiding them.

But uncertainty can be an obstacle to decision making. And scientific uncertainty is often misunderstood, particularly by the general public, and misinterpreted as ignorance. Many people fail to recognise the distinction between ‘school science’, which is a source of solid facts and reliable understanding, and ‘research science’ where uncertainty is engrained and is often the impetus for further investigation.

One of the arguments in favour of using the language of risk is that it shifts public debate away from the idea that decisions should be delayed until conclusive proof or absolute certainty is obtained (a criterion that may never be satisfied), towards timely action informed by an analysis of the comparative costs and risks of different choices and options (including doing nothing).

Another is that risk is an essential part of everyday experience, including the worlds of insurance, health, and investment. Many people have to deal with it daily and manage it in different ways: most people in the developed world take out house insurance against the low probability, very high impact event of a fire. Patients are increasingly familiar with the concept of the risks and benefits of different health treatments (though they rely on trusted intermediaries to help them to navigate the risk). And some of the risk assessments people make are on the same timescale as possible climate impacts – for example, taking out a pension policy into which they pay for 40 years.

There is also a growing body of literature suggesting that risk language may be a good, or at least a less bad, way of communicating climate change to the general public. Many argue that when compared to the messages of disaster or uncertainty that often surround climate change, risk is far from being a panacea, but it does offer a more sophisticated and apposite language to have the discussion in and a more helpful prism through which to analyse the challenge.

Risk can range in meaning from a broad sense of a possible adverse impact, to a narrow, more technical sense of assigning probabilities or confidence levels to different outcomes. Unlike previous analyses of media treatments of climate change, this study included an 'explicit risk' frame capturing a narrow sense of risk and compared it with three other narratives or messages often found around climate change: disaster (or implicit risk); uncertainty; and opportunity.¹

An examination of around 350 articles in three newspapers in each of the six countries with a combined circulation of at least 15 million² showed that the dominant messages that readers receive were predominantly ones of disaster or uncertainty. The language of risk (and of opportunity) was much less prevalent. This was true for most of the climate change stories examined, and across the different media and political contexts of the six countries, and the range of newspapers.

Our other main findings were:

- The disaster/implicit risk frame was present in more than 80 per cent of the articles, making it the most common frame. For coverage of three reports by the Intergovernmental Panel on Climate Change (IPCC), it was present in over 90 per cent of them. It was also the most salient (in the headline or first few lines) with 44 per cent of the articles containing the frame, more than twice the next most common frame. It was also by some margin the most dominant tone of all four frames with well over half the articles containing it.³
- Uncertainty was the second most common frame after the disaster frame. It was present in nearly 80 per cent of the articles. However, it was less salient, and much less frequently a dominant tone.
- Opportunity was the third most common frame, being present in 27 per cent of the articles. However, these were overwhelmingly the opportunities from not doing anything about reducing greenhouse gas emissions. Only five articles (less than 2 per cent) in the total

sample contained a mention of the opportunities from switching to a low-carbon economy.

- Explicit risk was the least present of the four frames, and the least salient. It was the dominant tone in just three articles, although it was often combined with other frames. Its presence would have been more marked if the articles covering the three IPCC reports had included an explanation of the concepts of likelihood and confidence levels – only 15 per cent of the articles did so.
- Journalists follow the prompts from scientists and their reports: 70 per cent of the articles covering the IPCC reports, and nearly 60 per cent of all the articles in the sample, included quotes from scientists or scientific reports expressing some variant of the disaster/implicit risk frame. Nearly half of all the articles included a quote that indicated some manifestation of uncertainty.
- The one major exception to the lack of variation between the six countries was the presence of uncertainty through sceptical voices: Australia had the highest number of articles in the sample with sceptics in them and the highest percentage of articles, followed by the USA.

The implication of this study is that the language and concept of risk is not yet as embedded into climate change coverage as other strong narratives. This may well change, as the coverage of the 2012 IPCC report on extreme weather events shows. Although this report was covered in far fewer articles than the 2007 IPCC reports, the explicit risk frame was present in half of them, and was often a dominant tone.

The continuing appeal of the disaster frame is to be expected, and is in line with other studies, confirming that journalists are generally attracted to gloom and doom stories. But journalists are going to become more exposed to the language and the concept of risks in covering climate science. Numbers and probabilities are likely to become more important in the coming years: as climate models become more powerful and sophisticated, their potential to quantify uncertainties and generate probabilistic climate projections will be enhanced. In other words, uncertainty will be measured in more helpful ways as a basis for making decisions, even though it will not be eliminated. Giving ranges of probabilities and reliability or confidence levels will be an essential part of that.

Another reason to understand probabilities better is because a major area of research by the climate science community is focused on attributing, in terms of changes in risk, the role that human-induced global warming may have played in making individual extreme weather events more or less likely.

Bridging the gap between specialists and journalists is becoming more difficult at a time when specialist journalism is in decline in many Western countries, in part due to the problems facing the business model of print media. It is a worrying trend that most journalists are now generalists yet they have to cover highly specialised areas of risk in finance, health or the environment. It is an urgent task to encourage and help journalists to bridge the gap. Specifically, journalists will need to be able to handle risk, numbers, and probabilities better in order to help a more constructive narrative about climate change than doom and gloom or uncertainty.

Amongst the study's recommendations are:

- More familiarity and training for journalists about numbers and probabilities will improve coverage of climate risks.
- More scope for inclusion in website articles of details and discussion about how uncertainty can be quantified and given a confidence level.
- More (judicious) use of info-graphics to illustrate the concepts of risk and other aspects of climate change.
- More use of probabilistic forecasting in public weather forecasting on television.
- More resources for the IPCC to be able to communicate effectively around its reports and to respond to media enquiries quickly.
- Scientists should stress early on during media interviews where there is broad consensus about climate science, and then later on where there are degrees of uncertainty. They should also try to explain that uncertainty does not usually mean ignorance.
- Using the language of risk in the context of uncertainty can be a helpful way of presenting the problem to policy makers; but more research is needed about the effect on the general public of different types of risk language to test when it is effective, under what circumstances, with what groups, and with what metaphors.

Acknowledgements

The Reuters Institute for the Study of Journalism (RISJ) is very grateful to the following organisations for funding this study:

The European Climate Foundation

The Grantham Research Institute on Climate Change and the Environment at the London School of Economics and Political Science

Klif, the Climate and Pollution Agency in Norway, a directorate of the Environment Ministry

The RISJ would also like to thank Green Templeton College for funding a conference on reporting risk and uncertainty held in November 2012, which provided invaluable material for this study.

Preface

First and foremost we are very grateful to the researchers for the individual country studies, who were consistently patient, resilient, and insightful in the face of constant demands on them: Lyn McGaurr, Research Associate in the School of Social Sciences at the University of Tasmania, and Libby Lester, Professor of Journalism, Media, and Communications in the same School; Anu Jogesh, Research Associate with the Centre for Policy Research, New Delhi; Toussaint Nothias, PhD student and Teaching Assistant at the Institute of Communications Studies, University of Leeds in the UK; Christian Bjørnæs, Senior Communications Advisor at the Center for International Climate and Environmental Research Oslo (CICERO), and Anja Naper, Research Assistant at CICERO; and Cassie Tickell-Painter, a researcher at Meteos, a think tank on health and the environment based in Oxford, UK.

A number of experienced environment journalists from the six countries we examined kindly found time to respond thoughtfully to questions from the researchers into their reporting of risk and uncertainty around climate change. They were, in Australia, Sarah Clarke of ABC and Ben Cubby of the *Sydney Morning Herald*; in France, *Le Monde's* Stéphane Foucart and *Le Figaro's* Marielle Court; in India, Meena Menon, the Mumbai Chief of Bureau for *The Hindu*; in Norway, Guro Tarjem, a reporter for NRK Radio; in the UK, Fiona Harvey, formerly of the *Financial Times* and now of the *Guardian*; and Alister Doyle of Thomson Reuters; and in the USA, Andy Revkin, the former *New York Times* environment correspondent and now the author of the Dot Earth blog.

The two official reviewers of the text, Rasmus Kleis Nielsen and Adam Corner, provided very helpful suggestions for changes, as did David Levy, Director of the RISJ. Detailed comments were kindly offered by Richard Black and Bob Ward. Vaclav Stetka helped with the design of the

content analysis. The long list of others who helped in differing amounts was Teresa Ashe, Curtis Brainard, Ros Donald, Anna Gerrard-Hughes, Catherine Happer, Ian Hargreaves, Chris Hope, Christian Hunt, Patrick McSharry, Tim Palmer, Chris Rapley, Yves Sciama, Juan Señor, William Solecki, David Stainforth, Liz Stephens, Nick Stern, Sophia Tickell, and Maya Tickell-Painter. Sara Kalim and Alex Reid from the RISJ have offered their customary, but greatly valued, support.

As always, all errors of judgement and fact are mine.

1

Introduction –

‘Even Ostriches Need Third-Party Insurance’

2012 was an extraordinary year for extraordinary weather.¹ The extreme became commonplace. It did not seem to matter much where you lived on the planet. The UK experienced some of the most unusual weather on record as the driest spring for a generation gave way to the wettest recorded April to June in a dramatic turnaround never documented before. By the end of December, England had suffered the wettest year on record, the whole of the UK the second wettest.

Many other parts of Europe had their worst cold snap in decades; in China the average winter temperature hit its lowest in 28 years; warmer temperatures in the Arctic were one factor behind a record low level of sea ice cover in September; Australia suffered its hottest summer since records began in 1910; the north-east of Brazil had its worst drought in decades; and in September, Nigeria experienced its worst flooding in 50 years.

In the USA, 2012 was particularly extraordinary for a series of weather extremes, many of them unparalleled in recent American history. The average temperature for the year was a full degree warmer than the previous record set in 1998. It was, in the words of a senior climate observer, ‘a huge exclamation mark at the end of a couple of decades of warming’ (Borenstein, 2013).

The area of contiguous USA (the 48 states not including Alaska or Hawaii) suffering drought conditions peaked at around 62 per cent in July – the largest area to be affected since the infamous Dust Bowl drought of December 1939. That July was the warmest on record in the USA for any month since records began in 1895.

Hurricane Sandy made landfall on 29 October near Atlantic City in New Jersey. At that moment, it registered sustained winds of 80 mph, and a central minimum pressure of 946 millibars, the lowest pressure ever recorded along the north-eastern coast. Parts of New York City harbour

registered a high water level of nearly 14 feet, beating the previous record by three feet. Sandy's storm-force winds covered more than 940 miles of the north-eastern US seaboard. It was the largest Atlantic hurricane on record, as measured by diameter.

Sandy's political impact may not have been as significant as the tens of billions of dollars of damages, but it was hardly negligible. President Obama could be seen being presidential and sympathising with victims, while the Republican challenger Mitt Romney struggled to find a role. But of central importance to this study was the reaction of the New York mayor, Michael Bloomberg, who threw his weight behind Obama because of Romney's failure to back climate change measures. The *Guardian* put these words from Bloomberg on its front page on 2 November:

Our climate is changing. And while the increase in extreme weather we have experienced in New York and around the world may or may not be the result of it, the risk that it might be – given this week's devastation – should compel all elected leaders to take immediate action. (MacAskill and Goldenberg, 2012)

The three concepts of climate change, uncertainty, and risk were all woven together in this short quote. The dominant sentiment was remarkably consistent with what most climate scientists would maintain about climate change and its link to the individual weather extremes described above. Despite recent advances in attribution modelling (see for example Otto et al, 2012; Pall et al, 2011; Stott et al, 2004), most of them regard it as misguided to attribute single weather events – and particularly tropical storms – too closely to human-made climate change. But it was Bloomberg's representation, or, to use the terminology of social science, his 'framing' of the climate change problem that was particularly interesting for those large groups of academics, policy makers, psychologists, and environment groups who have long grappled with the fiendishly difficult challenge of communicating climate change.² Bloomberg was linking climate change to current extreme weather events, rather than future ones, or in other words he made the threat immediate rather than future.

There is a growing sentiment amongst several experts that placing more emphasis on the climate change challenge as risk may be a helpful tool in framing or communicating the uncertainties around it. These advocates of a 'risk-based' approach argue that – in certain circumstances – such a framing can give policy makers more clarity about options and the process

of making decisions about them. Some also argue it is less of an obstacle to public understanding, engagement, and behaviour change than other ways of portraying climate change, although this view is more contested.

In 2010, Bloomberg's office wrote a report outlining the multiple threats posed to New York by climate change, called 'Climate Change Adaptation in New York: Building a Risk Management Response'.³ Bill Solecki is the co-chair of the New York Panel on Climate Change (NPCC) which wrote the report and an advisor to Bloomberg. He explains that 'when Bloomberg endorsed Obama like that, he was following the same logic we have been following at the NPCC. Our basic approach has been that it is hard to say that any one extreme event is climate change, but it is clear that the environmental baseline of the city is changing. So it is prudent to make the city more resilient for all types of climate risk – both present and future'.⁴

Bill Solecki is one of several experts who now portray the climate change problem as one of risk in a context of uncertainty – the risk that the continuing rise in greenhouse gas (GHG) emissions from human activities may well exacerbate weather extremes and cause widespread and harmful impacts. As has been well-documented, and as we shall review in Chapter 2, there are large areas of uncertainty that surround the climate, certainly about the past but more pertinently about the future. The planet's climate system is immensely complex and difficult to understand fully; the computer models used by natural scientists give multiple ranges of future temperature increases and potential outcomes; and social scientists are cautious about the possible pace, timing, and scope of the social and economic impacts from higher concentrations of GHGs in the atmosphere.

However, some eminent climate scientists and economists have long argued that although there are these important uncertainties surrounding the future of our climate, a better way of looking at the problem is to emphasise the risks. The US climate professor Stephen Schneider of Stanford University, who spent much of his life engaging in public discussion about climate change and thinking about the role of the media, was one of the first to employ the everyday concept of risk.

He would ask his audience, 'How many of you own a home?' Many of his (often well-off) audiences would put up their hands. 'How many of you have had a house fire?' Very few would put up their hands (typically it is much less than 1 per cent of households, although 1–2 per cent in California). He would then ask, 'How many of you have fire insurance?' Most people would put their hands up.

He would then proceed to point out that many people are happy to manage risk at a personal or household level, even when they are acting on a very low chance (less than 1 per cent) of a negative impact. But with climate change, he argued that the risk to the planetary life support system was much higher, and yet some sceptics were saying there was not enough certainty to take action.⁵

In the UK, the Conservative former secretary of state for the environment, John Gummer, uses the same analogy with the house insurance market. He called a talk in February 2013 at Oxford University ‘even ostriches have third-party insurance’,⁶ and drew parallels between how people deal with questions of insurance and how governments should deal with climate risks. He said that most British people are not ostriches and take out house insurance, but sceptics ‘were constantly saying that because there was no absolute certainty, we should do nothing’.

And in Australia, the leading climate scientist Professor Will Steffen uses a different form of risk language in describing the link between global warming and Australia’s recent records in weather extremes. He told the *Sydney Morning Herald* in March 2013 that ‘statistically, there is a 1-in-500 chance that we are talking about natural variation causing all these new records. Not too many people would want to put their life savings on a 500-to-1 horse’ (Siegel, 2013).

The seminal 2006 Stern report on the economics of climate change was probably the first to explicitly represent the climate policy problem as one of decision making in a context of uncertainty and risk. Its author, Lord (Nicholas) Stern, still argues that climate change is all about risk management, albeit on a colossal scale:

The main point is that this is all about risk management in some shape or form. Do we want to play Russian roulette with one bullet in the barrel or two? And even if we can't be that precise about one or two we can say that we can, through sensible action, dramatically cut the risks. And delay is dangerous because of the ratchet effect of a flow-stock process and the lock-in of capital and infrastructure. Thus those who favour inaction have to say that they know the risks are very small – agnosticism does not make their case.⁷

In his report, Stern famously recommended that it was necessary to invest 1 per cent of the world’s GDP annually for the next few decades to move from a high-carbon to a low-carbon economy (although he now says it is more like 2–3 per cent because of the greater costs involved in

keeping GHG emissions to below 450 ppm). Those who balked at the tens of billions of dollars this would entail were reminded that the global insurance industry, excluding life insurance, is worth 3.5 per cent of global GDP. As one Australian commentator observed at the time,

If the world is prepared to pay the equivalent of 3.5 per cent of its total annual output to guard against the possibility of all sorts of risks that, in any one year for any one client, are quite remote, such as fire and theft, then the prospect of paying a 1 per cent premium to protect against a catastrophic global event seems entirely reasonable. (Hartcher 2007)

A number of more recent reports have explicitly introduced the concept of risk into their titles and focus. Two stand-out examples of this are the March 2012 report by the world's most important climate science body, the IPCC (the Intergovernmental Panel on Climate Change), on extreme weather events (Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation or SREX report), and the UK Climate Change Risk Assessment (CCRA) of January 2012, which was the first of its kind in the UK.⁸ For example, the CCRA pointed out that there were a large number of uncertainties surrounding climate models leading to a wide range of possible results, but stressed (unusually) that not only were there some opportunities from climate change (new shipping lanes through the Arctic and fewer cold-related deaths in winter) but also multiple risks from flooding, heatwaves, and water shortages. Indeed, the CCRA press release mentioned the word 'risk' 19 times.

The portrayal of the climate change challenge as managing risk is certainly a growing trend, particularly in policy making circles, and this is just one reason why it is important to study the way the media report risk and uncertainty. There are several others.

Greater risk, but (in some areas) greater uncertainty too

In late 2012 a swathe of reports from the World Bank, the CIA, the International Energy Agency (IEA) and the United Nations Environment Programme (UNEP) all highlighted the growing possibility of a 3-degree or 4-degree warmer world by the end of the century, and the greater risks that this would entail (Clark, 2012). For example, the IEA warned in November 2012 that the world is likely to build so many fossil-fuelled power stations, factories, and inefficient buildings in the next five years

that it will become impossible to hold global warming to safe levels, which, in the judgement of governments, means less than 2°C.

In the same month, the World Bank's president, Jim Yong Kim, made an urgent plea for action to address the 'devastating' risks of climate change while launching the Bank's report 'Turn down the heat.'⁹ The report detailed the impact of a world hotter by 4°C by the end of the century, which the Bank described as 'a likely scenario under current policies'. It said that 'extreme heat waves would devastate broad swathes of the earth's land, from the Middle East to the United States. The warmest July in the Mediterranean could be 9°C hotter than it is today – akin to temperatures seen in the Libyan Desert'.

Proponents of the tipping point approach argue that one of these points may have already passed with the (then) record Arctic sea ice melt of 2007 (see for example Marshall, 2013). The tipping point approach holds that a system can exist in several more or less stable states, and that when a certain threshold is reached, it 'tips over' from the state we see now into another one. Furthermore, as there is an interconnected web of tipping points, when it comes to impacts or consequences of climate change, a small change can unleash a big change which may be unstoppable. For example, when the Arctic sea ice flips into a new, less stable state, this may push the planet quickly into another tipping point – the thaw of a vast expanse of the Siberian permafrost.

However, at the same time that the risks were being laid out with greater urgency, in an apparent paradox some prominent experts on climate change also stressed that, as researchers dig deeper into the field of climate science, more uncertainties about some aspects are being, and will be, uncovered. For example, one widely-quoted article in *Nature* written by a leading climate scientist argued that despite the advances in our knowledge about climate science, the 2013–14 report by the IPCC would have a *greater* amount of uncertainty in some of its predictions and projections, which could 'present a major problem for public understanding' (Trenberth, 2010). Indeed, a leaked draft of the first section of the report suggested that the IPCC was changing some of its projections about droughts, tropical cyclones, and ocean circulation (Marshall and Pearce, 2012). And the slowdown in the increase in global mean surface air temperatures since 1998 has led to heated debate in the media about climate sensitivity, or the amount of global surface warming that will occur if the concentration of CO₂ in the atmosphere is doubled (see for example *Economist*, 2013; Rose, 2013).

Public understanding of scientific uncertainty

As we shall see in Chapter 2, the general public are often unaware that many areas of science involve uncertainty whereas, for a scientist, uncertainty is often seen as something positive which can prompt further research. As the former director of the British Antarctic Survey, Professor Chris Rapley, observes, ‘there is a fundamental disconnect between scientists and non-scientists, as the general public associate science with things we know about with a good deal of certainty like gravity, DNA or the Higgs-Boson. But a lot of science is about uncertainties.’¹⁰ Even the word ‘uncertainty’ is frequently interpreted by the lay public to imply complete, rather than relative, lack of knowledge – or in other words, ignorance.

In the realm of climate science, the gap between public understanding and what most mainstream climate scientists believe has long been documented. Various opinion polls suggest that the public in many countries are confused about where there is broad consensus amongst scientists on aspects of climate science (for example, the warming trend and human influence), and where there is much less consensus or more uncertainty (the timing and extent of impacts, and what policy actions to adopt). For example, in the USA, one widely-respected survey in 2012 found that 54 per cent of Americans believe global warming is caused mostly by human activities, which compares with the 95 per cent plus of climate scientists who think it is.¹¹ The same survey suggested that only 44 per cent of Americans believe most scientists agree that global warming is happening. It is a surprising figure, and one that is replicated in other countries.

One of the many reasons for this mismatch is the way climate sceptics of different persuasions jump on the uncertainties, in order to cast doubt on parts, or even the whole edifice, of climate science. There is considerable evidence that in recent years climate scepticism has been on the increase in the Anglophone media, and in public opinion in some countries (Painter, 2011). On the other hand, green NGOs can downplay uncertainties as an obstacle to public engagement, for example by attributing an extreme weather event too specifically to man-made global warming. So, the misrepresentation of scientific uncertainty can have an adverse effect on public understanding.

The communication of uncertainty and risk

In recent years, there has been a proliferation of academic studies, many written by psychologists or communication specialists based on work with focus groups, looking at the different ways uncertainty and risk are communicated, and the effect of such messages on public understanding, engagement, and behaviour change (for an overview, see Moser, 2010: 37). In the specific area of climate science, the way the public receive, and react to, the information is in part a product of the way it is framed, either in the media or other forms of communication. For example, as will be discussed in Chapter 2, stressing uncertainties can lead to a diminishing of the problem in the minds of the reader or viewer. If scientists constantly talk about uncertainty, often the response of the listener is not necessarily apathy but lapsing into an unhappy situation of not knowing how to proceed, and therefore discounting or dodging the problem. Or some can even get angry when scientists don't know things. Some academics argue that climate change needs to be re-framed away from the technical uncertainties in the science and more towards the risks to society, and this change of emphasis can enhance engagement and understanding (Pidgeon and Fischhoff, 2011).

So a lot of research has already been carried out on the uncertainties and risks around climate change, the public understanding of these issues, and the way they are communicated and can be received. What's often missing is an understanding of what newspapers and journalists do when they cover risk and uncertainty, why they do it that way, whether they have the training and tools to understand scientific uncertainties, and whether they are sufficiently numerate to understand different concepts of risk.

The role the media play is crucial. After all, most people get most of their information about science from the media – maybe as much as 80 per cent of the population in the UK.¹² Of course, scientific news stories are often inherently specialist, containing ideas and language that are unfamiliar to most of the lay public. Risk and uncertainty are particularly difficult concepts to convey to the public and can make the journalists' job difficult. Moreover, the journalists are often being targeted by lobby groups of all persuasions to amplify or underplay uncertainties around climate science, which has at times contributed to a lack of nuance or complexity in reporting.

But the task of getting it right is an urgent one, going beyond climate science. Two cases taken from 2012 of the media's reporting of scientists'

statements involving risk and uncertainty, the first around cancer risks, the second around the risk of a major earthquake, illustrate both the challenges and the consequences of not getting it right. Although the cases are very different, they both highlight the essential question of what constitutes responsible reporting.

In the UK, studies have shown how the risk from eating red and processed meat in general, and bacon sandwiches in particular, has been exaggerated in the media, in part because of the way the press releases are written (Riesch and Spiegelhalter, 2011). For example, the *Daily Express* in a front page report on 13 January 2012 reported the potentially scary piece of information that a 'daily fry-up boosts cancer risk by 20 per cent'.¹³ The report was based on a study published in the *British Journal of Cancer*. At no point did the *Express* article point out that the 20 per cent increase in the chance of getting pancreatic cancer was from a very low base, and that the number at risk went up from 5 in 400 to 6 in 400 as a result of eating one sausage or two pieces of bacon a day. Six is a 20 per cent increase from five, so the relative risk did increase, but the absolute risk remained small. It was a classic example of not reporting the denominators, as we shall discuss further in Chapter 4.

A different set of issues arose from the case in Italy of three seismologists, two engineers, a volcanologist, and a public official being sentenced to six years in jail in October 2012 in L'Aquila for falsely reassuring or 'over' reassuring the general public about the likelihood of a major earthquake occurring in March/April 2009. For the media, the issue was in part whether they accurately reported the caveats and qualifications that the scientists said they included. For the scientists, the main issue was, as highlighted by the UK academic Brigitte Nerlich (2012), how scientists should:

navigate between the Scylla of being open about uncertainty and the Charybdis of public and political expectations regarding pronouncements of certainty, as well as, and perhaps more importantly, between the rock of scare mongering and the hard place of 'complacency mongering'.

This study aims to travel a small way towards filling some of the gaps about the media's reporting of future risks. Before taking a detailed look at this in Chapters 5 and 6, we review in Chapter 2 how researchers from different disciplines define uncertainty, and how this can differ from what the public understand by it. We then look more closely at the uncertainties around climate science, the way the IPCC communicates them in terms of

likelihoods and degrees of confidence, and the exploitation of uncertainties by climate sceptics.

In Chapter 3, we show how risk is part of our everyday experience, and particularly in the insurance, investment, and health sectors. We then outline the arguments in favour of using risk language and metaphors for the climate challenge, and assess its effectiveness in helping policy makers to make better-informed decisions, or in helping understanding and engagement from the general public. We end this chapter with an account of what experienced journalists think about the advantages and disadvantages of using risk language.

In Chapter 4, we review what other studies have shown about the way the media report uncertainties and risks in general, and also about climate science. We also discuss here what might help journalists and the general public understand risk better, such as more probabilistic weather forecasting on TV (in some countries) and the judicious use of info-graphics.

With all of the above as context, we then focus in Chapter 5 on the ways uncertainty and risk are reported in the (mostly elite) print media in six countries (Australia, France, India, Norway, the UK, and the USA). We carry out content analysis of the ways three newspapers in each country have covered two aspects of the possible future of the planet as a result of global warming: projections of global temperatures and of Arctic sea ice melt. The advantage of these two topics is that they both involve uncertainties, risks, and opportunities. Specifically, we examine the reporting of the IPCC's first two reports in 2007, the IPCC's SREX report of March 2012, and the reporting of Arctic sea ice decline.

We tested the relative presence in around 350 articles of four main 'frames,' namely uncertainty, disaster/implicit risk, explicit risk, and opportunity. A full description of these frames can be found in Chapter 5 but, given the focus of this study, we looked closely at the 'explicit risk' frame which includes numerical probabilities, the use of the word 'risk,' or the inclusion of everyday concepts or language like insurance, betting or not taking unnecessary risks (the precautionary principle). We tested the relative presence of these four frames, and give the aggregate results for all six countries, including any significant country differences. In Chapter 6, we give the social, political, and media context for each country followed by a detailed analysis of the results. Finally in Chapter 7, we draw out some conclusions and summarise some of the challenges and recommendations for scientists and journalists that arise from this study.

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